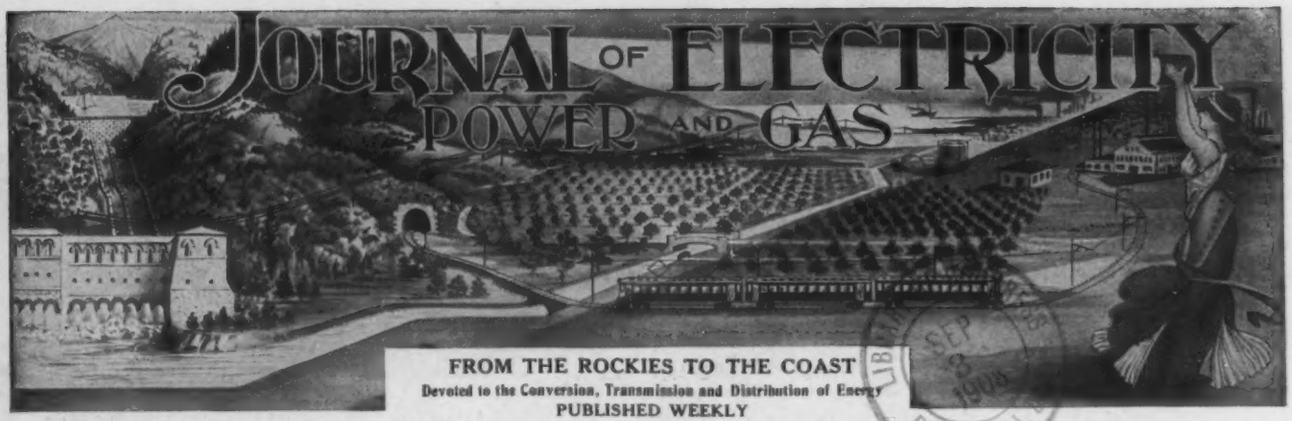
JOURNAL OF ELECTRICITY
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FROM THE ROCKIES TO THE COAST
Devoted to the Conversion, Transmission and Distribution of Energy
PUBLISHED WEEKLY

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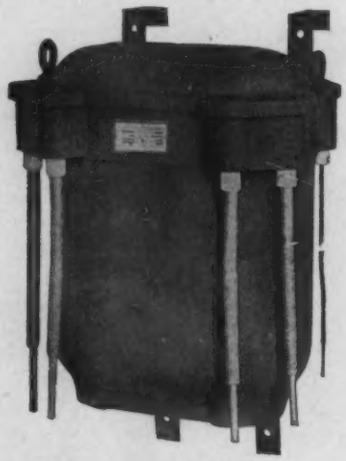

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# Journal of Electricity, Power and Gas

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## WATER POWER IN GERMANY.

In response to a request for a report on the development, control, and use of water power in Germany, Consul-General A. M. Thackara forwarded the following, his statements being arranged in the order of interrogatories propounded:

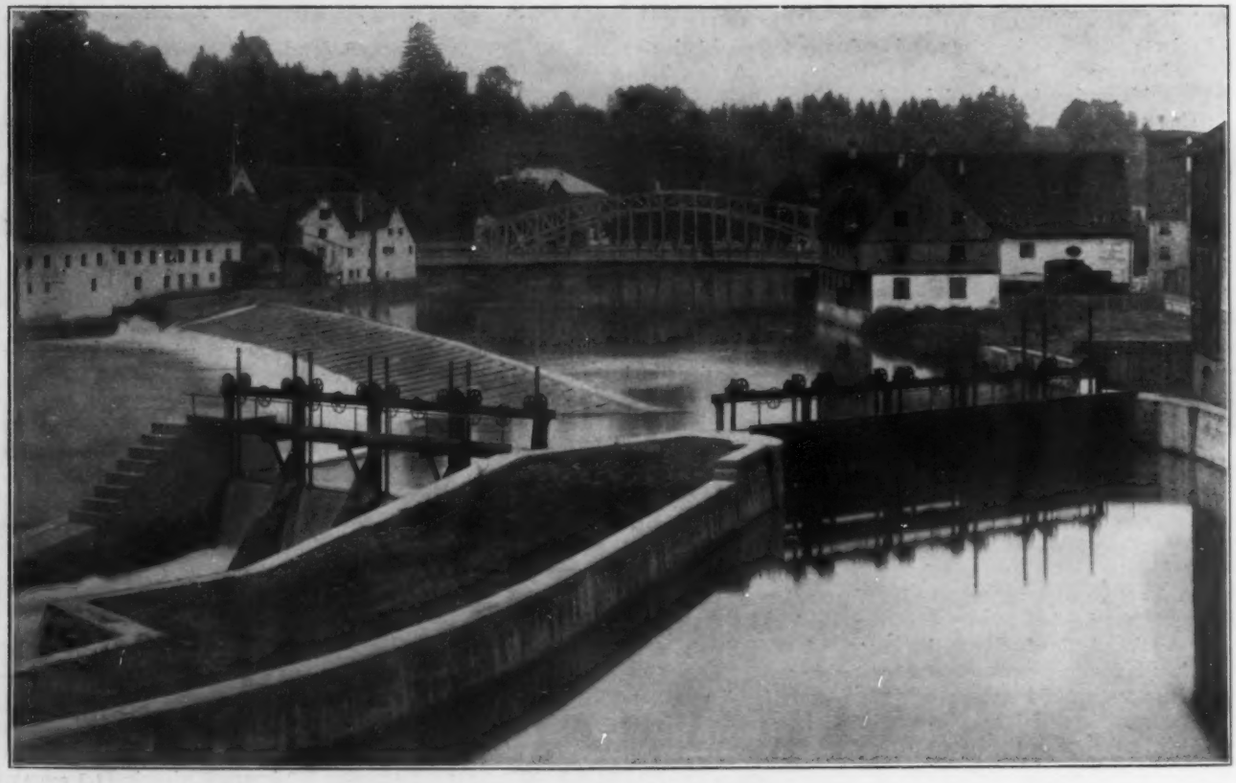
Question 1. The laws of Germany relating to the development and use of water power?

Water rights in Germany are not regulated by Imperial legislation; neither do the use and development of water power come within the scope of the Imperial Government. At the formation of the German Empire the right of eminent domain over the public water was reserved exclusively to the sovereign States joining the Empire and now composing the same.

The laws governing water rights enacted by the several States and the various governmental decrees, rules, and ordinances which were the law of the land at the time the Empire was founded remained in full force and effect and subject only to changes and amendments by the several States themselves.

In the contemplation of the German law, from time immemorial the public waters—that is, the rivers navigable by nature, the seashores, and the seaports—are the property of the State, as a part of its sovereignty for common use. The right of usage of these waters may be acquired by private persons, communities, or municipalities from the State government for certain purposes, subject to governmental supervision and control.

The uniform policy of the German States heretofore has been not to exercise governmental control or ownership by reason of eminent domain over the public waters, so as to make them a source of fiscal revenue, as, for instance, by the erection and management of water works for the supply of water or by the construction of works for the development and use of the water power, etc.



**Hydro-Electric Plant in Southern Germany.**

On the adoption of the new civil code for Germany in 1900, establishing a uniform private law in all the German States, the existing laws relating to the water rights in the various States were left unchanged, and legislation regarding water rights and the use of public waters was again specifically reserved to the several States.

Articles 65 and 66 of the Introduction Law (Einfuhrungs-Gesetz) to the Civil Code, provide that: "The provisions of the several State laws governing the water rights, inclusive of the mill rights, accesses to the banks of rivers, rafting, the promotion of irrigation and drainage of real property, right of landing

places, the formation of islands in the rivers, the river beds, dams, and embankments shall remain unaffected."

**Ownership and Control.**

2. Whether or not the German Government develops the water power under Government ownership and control and rents and sells the power for use of manufacturers, millers, etc., or whether or not the powers are developed by private capital and the power rented or sold exclusively for the benefit of private owners?

Up to the present time, with a few exceptions, the governments of the several German States do not develop the water power under government ownership, nor do they control and rent and sell the power for the use of manufacturers, millers, etc.; neither is the power all developed by private capital and the power rented and sold exclusively for the benefit of private owners.

Only during the past twenty years has the utilization of the water power of Germany by the several States under government ownership been taken into consideration. The question is also being agitated by private parties so as to bring about a co-operation between them and the public authorities.

In Prussia at the present time, government ownership of waterworks for power and other purposes is being seriously considered. An exhaustive report presenting the ways of utilizing the public waters as a means of fiscal revenue, has been prepared by the ministry of public works, the department of the government which has supervision over all matters pertaining to the public and private waters, and recommending that proper legislation to that end be enacted by the Prussian Parliament. Action, however, on this project is being deferred.

The Bavarian Government proposes to take up the matter of governmental ownership of the waters in the Province of Upper Bavaria. A bill for the purpose has been drafted, and it is thought that legislation to that effect will soon be enacted. The purpose in view is to establish waterworks for the generation of electricity from which to furnish the power to run the railroads in South Bavaria.

Baden has taken the lead in exercising governmental ownership of water power by the erection and management under governmental control of the small electric water-power works at the port of Kehl, on the Rhine, to supply the railroad stations and the navigation works of the said port with electricity.

The waterworks of the city of Nordhausen, in the Harz Mountains, are an illustration of municipal ownership of water-power works.

**Provisions for the Use of Water.**

The system hitherto universally prevailing in the German States for the use of the water, is that the erection and management of waterworks are carried out by the water associations known by the German name of "Wasser-Genossenschaften." These are quasi public corporations, organized under the special laws mentioned above, under the enumeration of the laws of Prussia relating to water rights and water power.

These semi-official corporations are organized either entirely by private owners of land who are being directly or remotely benefited by the use of the waters, or municipalities, or by a combination of both municipality and private individuals.

It is a special feature of the laws governing water associations that the membership of all persons is legally made compulsory whose real property is held to be benefited by the purposes and the object of the association, whether it be by the reason of a supply of drinking water or of furnishing power or of drainage or irrigation or of other ameliorations.

The right of appropriation of private property on the assessment of damages is also an essential feature of the said laws.

These associations being corporations for profit, are also being organized under the general German law of the "Code of Commerce" governing companies with a limited liability.

A leading illustration of these latter corporations is one in which the city of Aix la Chapelle is the principal stockholder. This company is called the "Ruhrthal Sperrengesellschaft G. m. b. H."—a limited liability company. It is named after the river Ruhr, near which the city is situated. It was organized on March 20, 1890, with seven incorporators, composed of the Mayor of the city of Aix la Chapelle as the representative of the city by virtue of a resolution passed by the City Council, a commissioner (landrat) of the county of Aix la Chapelle (landkreis of Aachen), empowered by resolution of the County Commissioners and of five commissioners representing and empowered by five other adjoining counties or "landkreise."

This company, the title of which, "Ruhrthal Sperrengesellschaft," means company for the storage of the waters of the river Ruhr, was organized with a capital of 5,000,000 marks ($1,190,000), to which the city of Aix la Chapelle, the county of Aix la Chapelle, and two other counties subscribed 1,000,000 marks ($238,000) each, two counties subscribed 320,000 marks ($76,160) each, and one county 360,000 marks ($85,680).

The object of the company, as stated in the articles of corporation, is as follows: The erection and maintenance of reservoirs (sammelbecken) for the river Ruhr and its tributaries for the purpose of improving the condition of the said river courses, and to better utilize the water and the water power by the erection of aqueducts, by drainage and irrigation, and also by the construction of electricity works, water motors, pumping works, and the transmission of power for farming, for the industries and for small trades, in a manner so as to be of common benefit.

It is one of the duties of the said company to offer the power produced to the parties in interest, especially to the city of Aix la Chapelle, at rates in proportion to the amount of the capital invested by fixing the prices upon an equitable basis.

**Charges for Use of Power.**

3. The charges for power so rented or sold either by the State or private owners.

The above-mentioned Ruhrthal Sperrengesellschaft charges its four membership customers: (1) City of Aix la Chapelle; (2) County of Aix la Chapelle; (3) County of Duren, for electric light 4.1 pfennig (0.976 cents); and (4) the County of Schleide 3.7 pfennig (0.88 cents) for the kilowatt hour, and a further reduction of ten per cent if the dividend of the company exceeds five per cent; but it is a condition that an annual consumption of between 2.3 and 8.5 million kilowatt hours must be guaranteed and paid for.

These membership customers are restricted in their sales to others to a tariff, imposed by the management of the company, by which a charge of between 25 and 40 pfennig (5.95 to 9.52 cents) for the kilowatt hour is made.

Electricity for power purposes is sold: (1) At low pressure from 8 to 35 pfennig (1.9 to 8.33 cents); (2) at high pressure (5,000 volts) at 4½ to 25 pfennig (1.07 to 5.95 cents), according to annual consumption.

A more uniform consumption is given a better rate; for instance, a consumer using ten horsepower in twenty-four hours is given a better rate than one using twenty-four horsepower in ten hours.

(2) The Valley Storage Waterpower Works of the city of Solingen, built in 1903, charges for light 45 pfennig (10.71 cents) per kilowatt hour, on a consumption up to 350 hours a year; above that, 25 pfennig (5.95 cents) a kilowatt hour; for power, 18 pfennig (4.28 cents) per kilowatt hour, on a consumption of 750 hours a year; exceeding 750 hours, 8 pfennig (1.9 cents) per kilowatt hour.

These works have a capacity of 450 kilowatt hours. In the spring of 1904, one year after construction, they were connected with 140 motors with a consumption of 209 kilowatts and had a lighting capacity of about 6,550 incandescent lamps of sixteen candle light each. During the year 1904 the total output for light and power amounted to 278,000 kilowatt hours, and in 1905, to $388,800 kilowatt hours, an increase in one year equal to forty per cent.

In the spring of 1906 they were connected with more than 500 small motors.

(3) The charge of the Ennepethalsperre for electrical energy is 20 pfennig (4.76 cents) for the kilowatt hour for power, and 35 pfennig (8.33 cents) for light, much lower than the rates of the largest cities of the neighborhood.

This plant was put into operation in 1904, and has a yearly capacity of 1.9 millions of horsepower hours.

According to the statutes of the company, the proportion of the general expenses which each member using the power has to bear, is determined in the following manner: For each horsepower of the motor a rate of 30 marks ($7.14) is charged yearly for the daily use of the motor, in addition to which a gross sum is paid yearly, according to the size of the motors, as follows:

Up to 5 horsepower, $7.14; from 5 to 10, $9.52; from 10 to 15, $11.90; from 15 to 20, $14.28; from 20 to 30, $19.04; from 30 to 50, $23.80; above 50, $28.56.

**Horse and Steam Power Compared.**

4. The water horsepower in use as compared with the steam horsepower?

On April 1, 1905, Germany had 375 public electricity works with an aggregate capacity of about 107,800 horsepower, the greater part of which was generated by water power.

According to the industrial census of 1895, the aggregate capacity of all motors in use in the industries was 3,428,000 horsepower. Of this, 79.4 per cent was furnished by steam power, and 18.4 per cent, or 629,000 horsepower, by water; both together were 97.8 per cent of all the power used by the factories in Germany.

In Prussia in the year 1898 there were in operation 19,567 water-power works with a total capacity of 219,500 horsepower, the average capacity being 11.2 horsepower.

According to the statistics, the capacity of all steam engines in use in Prussia April 1, 1905, with the exception of railway locomotives and engines used by the army and navy, was 5,440,000 horsepower.

5. Uses to which the water power is applied?

Water power in Germany is mostly applied to the generation of electricity for lighting and industrial purposes. It is also used for pumping water into reservoirs for supplying cities with water and for irrigation and for drainage. As an illustration of the uses of water power for the generation of electricity for industrial purposes, the following statement relating to the waterworks of the Wupperthal Sperren Genossenschaft, erected in the region of the source of the river Wupper, emptying into the Rhine, may be of interest:

Electric power is furnished by the company to the following plants, viz., five powder mills with sixteen motors, one bone mill with one motor, nine grain mills with ten motors, fifteen cloth factories with fourteen motors, seven spinning works with five motors, three hammer works with thirteen motors, six electricity plants with seven motors, sixty-four printing works, dyeing works, bleaching works, weaving works, etc., with nine motors, four wire-thread works with three motors, one flat-iron factory with one motor, four paper factories with six motors, nineteen grinding works with twenty-seven motors, one felt factory with two motors, one woodenware factory with two motors, one waterworks and electric works with three motors, two hinge and metal screw factories with six motors.

## ELECTRICITY IN AGRICULTURE.

In England, electricity has been experimentally applied to agriculture on a large scale by Sir Oliver Lodge. Wires were strung on 15-foot poles equipped with high-tension insulators, and placed 30 feet apart over 19½ acres of ground. A dynamo driven by a 2-horsepower oil engine supplied 3 amperes at 220 volts, which was raised to 100,000 volts by an induction coil. It then passed through rectifiers, one pole of which was connected to the system of overhead wires and the other grounded. The leakage from these wires is said to have stimulated the plant growth so that crops of wheat, barley and strawberries showed an increase of from 25 to 35 per cent. The flour made from the wheat was of better quality, and sold at a higher price, as it contained a larger proportion of dry glutens and was better baking.

## THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION—ITS GROWTH AND WORK.

In the year 1901, the electrical contracting business had hardly risen to the dignity of a recognized position in the building trades of the country, and almost any one with a screwdriver or pair of pliers advertised himself as an electrical engineer and contractor.

This condition made the reputable contractors feel that something was necessary to improve the trade conditions, and they believed that such improvement could only be brought about through an organization that was national in its character.

With this end in view, a meeting was called in Buffalo, N. Y., on July 17, 1901, to discuss the advisability of forming a national organization, composed of electrical contractors.

It was evident from the attendance at and interest in this meeting, that such an organization was believed to be a necessity throughout the country.

Many delegates who attended this first meeting, represented a number of contractors from the cities in which they did business, and consequently were unable to take definite action at the time of the meeting.

The sentiment, however, was so strongly in favor of an organization, that the National Electrical Contractors' Association was formed at this meeting, with a membership consisting of thirty-one contracting concerns.

From then until the present time, there has been a steady growth, and the organization now has a membership covering practically the whole country, and including a large proportion of the electrical contractors. The object of the organization is to improve the conditions in the contracting trade in every possible way, and working with other national organizations in the electrical field, it has brought about the recognition of the electrical contractor, and made the electrical contracting business a recognized factor in the building industry.

The Association has a Board of Directors composed of prominent electrical contractors throughout the country, and this Board is at all times ready to take up any question that the membership deems important.

The special work of the organization requiring constant attention, is handled through committees.

One of the most important subjects which confronted the contractor was the question of wiring rules and the inspection of electrical work.

A committee was appointed in 1902 to take up this subject, and the work of this committee resulted in the organization being allowed the privilege of the floor at the meetings of the Underwriters' National Electric Association, and also a membership in the National Conference on Standard Wiring Rules.

The policy of the organization has been to make rules more definite and strict, in order to raise the standard of electrical construction work. Also, to bring about a uniform interpretation and enforcement of the rules as embodied in the National Electrical Code, and much progress has been made along these lines.

The matter of legislation for the licensing of electrical contractors is another matter of great importance to the trade, and the National Association has advocated the passage of proper license laws, both by State and municipal government.

The committee dealing with this subject has collected and is still collecting valuable data, which is furnished to any of the members that desire to take up the question of such laws.

Another subject that early occupied the attention of the Association, was the difficulty in figuring electrical wiring installations on account of the different symbols in use by the different architects and engineers.

Feeling that a uniform set of symbols would be of great benefit, not only to the contractor, but also to the architect and engineer, a committee was appointed to take up this subject.

The work of this committee resulted in the adoption of a set of standard symbols, which have been adopted by the American Institute of Architects and several departments of the United States Government.

The use of these symbols saves the contractor much annoyance and lots of time in making estimates, and prevents many misunderstandings.

Along this same line a committee is now working on the subject of uniform specifications, and will undoubtedly report a draft of such a specification at the next meeting.

The question of labor, which is, of course, important to any organization composed of parties interested in the building trade, has been carefully considered by a standing committee appointed by the Association for this purpose.

This committee has collected a great deal of data on the subject, which is available for the use of the members at any time.

In addition to this, the ability to obtain information and assistance from all sections of the country, is of great benefit to members of the National Association.

The question of buying and selling material is one that is always important to a business organization, and a standing committee to consider this subject was one of the first committees appointed by the Association.

From the start the organization has felt that the proper regulation of buying and selling conditions could only be accomplished through concerted action by the manufacturers, jobbers and retailers, or, in the electrical business, the contractor.

The Association is working along these lines, and believes that eventually a condition will prevail that will be satisfactory to all parties interested in the electrical industry.

Believing that improvement always results in co-operation in any line of business, the organization has a special committee which is a part of the Co-Operative Electrical Development Association, and it is believed that working with this organization will result in benefits to the contractor, as well as to the electrical business in general.

In connection with the work of the National Association, a publication was started in 1901, called "The National Electrical Contractor."

This paper is devoted entirely to the interests of the electrical contracting business, and its columns are open for the discussion of any question that is of interest to the trade.

Much good has been accomplished through this medium, giving the contractor, as it does, an opportunity for the exchange of information, not only with members of the Association, but with practically all of the contractors throughout the country.

It seems an almost self-evident fact that under existing business conditions, organization is necessary in every line of trade, and, considering the broad lines on which the National Electrical Contractors' Association was formed, and the extremely moderate fees for membership, it should be supported by every reputable contractor in the country, who is interested in the advancement of the business.

Application for membership should be made to W. H. Morton, 94 Genesee Street, Utica, N. Y.

## EXAMINATION FOR IRRIGATION ENGINEER.

The United States Civil Service Commission announces an examination on September 23-24, 1908, to fill at least three vacancies in the position of irrigation engineer in connection with the Irrigation Investigations of the Office of Experiment Stations, Department of Agriculture, at salaries ranging from $1,500 to $2,000 per annum, according to qualifications, and vacancies requiring similar qualifications as they may occur. The examination will consist of practical questions in irrigation engineering; thesis (a thesis of not less than 1,000 words. Competitors will be permitted to select one of two subjects given); drawing (a practical test of the competitor's knowledge of irrigation and his ability to draw and letter); education, training, and experience (rated on application).

## SAFETY IN HIGH-SPEED ELEVATORS.

To the Editor.

Sir: Formerly the first question of importance to be considered about an elevator was that of safety, Is it a safe elevator? And the answer used to be: "Oh, yes; nobody was ever killed or injured on one of our elevators." This question of safety recurs now at intervals, generally after some frightful accident has happened, like that in the American Tract Society Building, for example, in this city some years ago. That accident and others about that time set owners of high buildings to thinking, and the big corporations and syndicates who were contemplating investments in sky scrapers welcomed the advent of the plunger elevator, as being an elevator that could not fall and kill people; when it was demonstrated by the plunger elevator people that this type of elevator could be operated successfully and well, in high buildings, expensive as it is to install, it was very generally adopted in the best class of buildings then under construction in New York. The plunger elevator was not, however, calculated for any such high rise as the Singer and Metropolitan Life towers, with their 40 or 50 stories.

The use of steel construction in framing has made such structures possible and has thereby created a most insistent demand quite recently on the part of these owners for an elevator that would get there, and get there quickly, too. Speed on high runs is the thing that is demanded.

We now have such an elevator, and it is quite a new thing in a way. It is electrically operated and is known as the traction elevator, but as a matter of fact it is a friction-drive elevator, to be exact. The word traction is a misnomer, but that word is less suggestive of danger and sounds better. Stripped of its accessories, this friction-drive elevator consists of a grooved iron drum at the top of the shaft, actuated by a slow-speed electric motor, wherein the extension of the armature shaft of the motor forms the drum shaft; the wire ropes are not fastened to this drum, but are attached to the counter balance weights at one end, and to the car at the other end, after passing around the overhead drum or sheaves a sufficient number of times to produce the necessary friction for moving the loaded car. Evidently such an elevator is capable of very high speed and can be made to start, stop, and reverse without shock or jar. It is also evident that the counterbalancing of the car in this elevator must be kept within certain well-defined limits; in other words, practically the entire load in the car is unbalanced load, which makes this elevator a good consumer of electric current.

In every type of hydraulic elevator, as well as in the drum type electric elevator, there exists in the machine itself a positive retarding force, constituting a factor of safety, which this friction drive or traction elevator does not possess. The controlling devices on this flyer are its main dependence for safety; should the apparatus once get beyond the control of the operator, the automatic stops would not become operative until the maximum rate of car speed had been exceeded.

The writer was present not long since at a meeting of the American Society of Mechanical Engineers in this city, the subject announced for discussion being high-speed elevators. Everybody expected to hear something interesting about this new elevator flyer, and a lot of elevator men were there; the engineers who were present evidently came to listen, and said nothing; elevator advocates talked in a more or less rambling fashion about this new elevator, and the meeting was neither exciting nor edifying. Purchase, combination, and trade agreements have silenced not only competition, but criticism. Owners of elevators are classed as common carriers in law along with railroad and steamboat companies, and are responsible in theory at least for the safety of passengers.

New York, August 3, 1908. W. H. L.

## ATTITUDE OF THE LAW TOWARD ELECTRICITY.

By Emerson W. Read*

Electrical companies are each year more impressed with the necessity of guarding against damage from lightning. However, not only is there need for protection to apparatus, buildings, and wiring; the law has laid down certain rules requiring companies which stretch wires and erect various appliances peculiarly adapted and situated to attract lightning, to protect those who are endangered by such wires and appliances during lightning storms.

While electrical companies have no special control over atmospheric electricity, yet it is because of their apparatus that damage is often done. Some courts have viewed lightning damage through electric wires as a direct consequence of "act of God." An Arizona court has decided that an electric company, in extending its wires into a building for proper purposes, is under no obligation to insulate such wires to give protection to the building and its occupants from lightning stroke. The court explained that lightning was electricity having its origin in the clouds or atmosphere. (Light, etc., Co. vs. Bennett, 74 Pa. 48.) Generally the rule is not so lenient as this. In a district where lightning storms are notoriously common and destructive, companies are held to the obligation of protecting their patrons and the public from injury by lightning discharges on their apparatus as far as reasonable and diligent care may protect. If there are reasonable grounds to apprehend that atmospheric electricity may be conducted over telephone wires and other apparatus to and into a house wherein a company has placed certain apparatus and appliances known to attract lightning, and there do injury, and appliances and devices exist which are well known to the company as competent to prevent such consequences, it is the legal duty of such company to acquire and use such devices in an effort to guard against accidents resulting from lightning. (Griffith vs. New England Tel., etc., Co., 72 Vt. 441.)

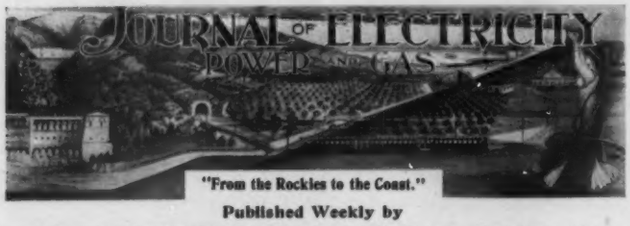
To have allowed wires no longer needed to remain attached to a house as a consequence of which damage by lightning resulted, is negligence on the company's part. Where a telephone company, after having removed their telephone apparatus from a store, instead of also removing the wires connecting with the house, merely cut them from the instrument, leaving the ends hanging twisted together, whereon lightning struck them and was conducted into the building and was discharged therein to the injury of the occupants, the company is liable for the resulting damage. The court held that this liability of the company extended to the customers of the store as well as the tenant. (Bell Southern Tel., etc., Co. vs. McTyler, 34 Sout. 1020.) To illustrate the extent of judicial investigations in such matters quotations from that decision will show much: "Atmospheric electricity, or lightning, is frequently discharged from clouds and passes to the earth; that metal wires strung in the air are good conductors of electricity, much better than the air; that animal bodies, the bodies of human beings among the rest, are also better conductors than air or wood; that electricity so discharged in the vicinity of such wires is liable and apt to pass into them and along them to their ends, and thence through the best conductors at hand into the earth; that if a human body is in contact with the end of the wire, the current will pass through it to the ground, and that, though not in actual contact with the end of the wire whence the current must go to the ground, but near to it, the current, instead of passing through the air to the ground, will seek the better conductor of the body, pass through the air to it, and through it to the earth. Of course, the higher the wires extend, the nearer to the point of discharge in the air, the greater the likelihood that the current will pass into them, and the greater the extent of the wires horizontally, the more danger there is of receiving and carrying the electric currents. It may also be said to be common knowledge that where two wires are strung near to each other, within a foot or two, on poles through the air, after the manner of telephone and telegraph wires, there is a likelihood or liability that lightning, in its descent from the clouds, will strike and follow both of them to their ends, unless diverted by other more attractive conductors, and must necessarily then pass from them to the earth through the best conductor then in its general pathway." At a further point in the decision the same judge (McClellan, C. J.) says: "If by the exercise of such reasonable precautions as a man of ordinary care and prudence would exercise in respect to such a dangerous agent, injuries to persons and property from the conduction along the wires and into the houses of atmospheric electricity may be avoided, it is the duty of companies engaged in this business to employ devices and appliances to that end. If the danger cannot be wholly avoided, due care should be taken to minimize it; and if such care is taken and there still inheres in the operation of the system a modicum of unavoidable peril to persons and property, its consequences are to be risked and submitted to in consideration of the conservation of public convenience to which they are necessarily incident." "The only justification for their (wires) being carried into a building and maintained there is the telephone service thus supplied by means of them. If they are put there not for that purpose, but for the mere convenience of the telephone company, and allowed to be in such condition as that persons and property in the building are liable to be injured by lightning gathered and brought into the building by them and there discharged, their mere presence is a wrong."

A very similar ruling occurs in Southwestern Tel., etc., Co. vs. Robinson (50 Fed. 810), showing negligence on the part of one of these companies by neglecting to dispose of wires no longer in their proper position. The wire had fallen from its usual position to a position across a public road, suspended only a few feet from the ground. In this position it had hung for several weeks when a lightning storm arose and a traveler, coming in contact with the displaced wire, was injured by a discharge of electricity attracted from the atmosphere. Here again was a case where a company, handling a contrivance notoriously known to be dangerous in such storms, had neglected to exercise its due measure of care.

*B. L., LL. B., Member of the San Francisco Bar.

## INTERNATIONAL CONGRESS ON ELECTRICAL UNITS.

The international congress on electrical units and standards will assemble at Burlington House, London, in October. The general object of the gathering is to consider and advise as to the steps which should be taken to bring about an agreement in the definition of electrical units which form the basis of legislation in different countries, and in the method of constructing and employing the electrical standards necessary to give effect to these definitions. It is hoped that the delegates will be able to embody their conclusions in draft articles for the consideration of the various governments with a view to uniform legislation. The conclusions arrived at by the representatives of the various national standardizing laboratories who met in 1906 will be brought forward as a basis for discussion. They are also generally in accordance with the decisions of the Chicago Congress, held in 1893.

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**UTILIZATION OF ATMOSPHERIC NITROGEN.**

The tiller of the soil may be likened to the owner of the magical wild ass' skin in Balzac's story of the "Peau de Chagrin." While the possession of this skin gave the means of satisfying every wish, yet its size represented the duration of the owner's life, and for every desire gratified the skin shrank accordingly, until finally both life and hide vanished with the gratification of the last wish. Similarly nitrogen and other foods required for the growth of plants are withdrawn from the soil by each successive crop, until at last the land becomes exhausted—the electrolyte in the storage batteries which furnish the power used by man is low. It has been found, however, that by adding nitrogenous compounds to the soil its fertility may be restored. But so rapidly—more rapidly than they are being replenished—have the natural manures been depleted by an ever-increasing demand, that all available guano and sodium nitrate deposits will ultimately be exhausted. The sorry plight of the Ancient Mariner, "water, water everywhere, nor any drop to drink," until recently bid fair to be that of the farmer, living in a sea of nitrogen but unable to use it for his most pressing need, that of fertilizing a wasted earth. Protean nitrogen is an essential constituent of protein, and thus of protoplasm, "the physical basis of life." Neither plants nor animals can exist without nitrogen, and yet they cannot assimilate it from the air they breathe. Electric power, however, now coverts the nitrogen of the air into forms that can be readily utilized by plant life, and thus by animals.

Nitrogen is one of the most abundant, and at the same time one of the most expensive elements. There are nearly twenty million tons of nitrogen in the air over every square mile of the surface of this earth, or over seventy million times as much as is contained in the 1,740,000 tons of saltpetre exported from Chili in 1907. Though it exists in such enormous quantities, heretofore it has been directly used by only a few plants which were able to absorb the nitrogen from the air diffused through the soil. Here it is that the puny strength of the tiny microbe is more powerful than the mighty force of the lightning in causing combination.

It seems strange that elementary nitrogen is so inert, and yet its compounds are so singularly active; inert as a diluent of the air, active in explosives and in the poisonous alkaloids such as morphine and strychnine. Because of this marked inertness, possibly due to the strength of the atomic bonds within the molecule, and because of the indirect processes by which its compounds are formed, as well as their usual instability, the fixation of atmospheric nitrogen has been a difficult task.

To accomplish this two methods are now employed commercially. In Norway an alternating current electric arc is being used to oxidize the nitrogen

by the Birkland and Eyde process. A factory is producing calcium nitrate thus made. More practical results are being obtained by passing nitrogen over hot calcium carbide which is made in the electric furnace. Two atoms of nitrogen take the place of one atom of carbon to produce calcium cyanamide, the intense heat necessary for the reaction being obtained by an electric resistance.

In a paper recently read before the Faraday Society, Dr. Albert Frank gives some interesting details of the process. The nitrogen is obtained by fractional distillation of liquefied air by the Linde system, or by the "copper process," in which air has been passed over bits of heated copper which take up the oxygen and allow the free nitrogen to pass to the retorts. As soon as the carbide is saturated with the nitrogen, the calcium cyanamide is taken out and cooled. The crude material contains twenty per cent of nitrogen.

It was anticipated that the greatest use for this nitrolime would be as an economical fertilizer. This function it performs admirably and the farmer is assured of an ample supply for his needs. But it has also been found useful in other arts. Potassium cyanide, used to extract gold from its ore, is readily prepared from it, as is also thiocarbamide which is stated to possess the same quality. Ammonia and some of the synthetic dyes may also be made from it. Several explosives employ it in their composition and it has been successfully applied to the case-hardening of steel. These are but a few of the many uses to which it may soon be put.

Anticipating the demand, plants for its production have been built in Italy, France, Switzerland, Austria, Germany and England, as well as in the United States and in Japan. Factories with a total production of 45,000 tons annually are expected to be in operation by the end of the present year. Others will undoubtedly be built throughout the world, again showing the fundamental necessity for electric power as the basis of modern civilization.

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## PERSONAL.

Ralph L. Phelps has returned from an extensive trip through the Northwest.

R. D. Holabird will be in San Francisco for several weeks before returning to Los Angeles.

R. E. Heine, electrical engineer with D. H. Burnham & Co., and H. S. Tittle left for a trip East on August 25.

W. W. Hanscom, manager of the Century Electric Construction Company, of San Francisco, was married on August 19 and is now at Del Monte.

W. S. Berry, formerly manager of the Western Electric Co., at Cincinnati, has come to San Francisco to act as sales manager for the company at San Francisco in place of H. H. Manny, resigned.

## DEATH OF W. M. HABIRSHAW.

W. M. Habirshaw, founder of the Habirshaw Wire Company of New York, and a pioneer in the manufacture of rubber-covered wire, died at Saratoga, N. Y., August 15th, 1908.

No better tribute can be written to his memory than that included in the following minutes and resolutions adopted by the board of trustees of his company at a meeting held on August 17th, 1908:

On Saturday, August 15th, 1908, at Saratoga Springs, New York, William Martin Habirshaw died in the seventy-fourth year of his age.

From early manhood Doctor Habirshaw occupied an honorable and distinguished position in both the business and scientific world.

After retiring from the United States Navy, where he served as an engineer, he began his career as an analytical chemist, and soon rose to the front ranks in his profession. He became a member of the Chemical Society of London, and of other scientific organizations both here and abroad.

At an early date he perceived the commercial possibilities of electricity, and organized and became president and general manager of the India Rubber & Gutta Percha Insulating Company, a pioneer in this line. His sterling honesty and exceptional scientific ability gave the company a high standing. Its title was recently changed to that of the Habirshaw Wire Company, and he continued to maintain a most active interest in the affairs of this company up to the time of his death.

For the past five years he has been a sufferer from a disease which he knew to be incurable. During this long period he faced the inevitable with calmness and bravery. His honesty, hospitality, loyalty, and exceptional scientific attainments drew around him a large circle of friends to whom his death will come as a deep personal loss, in which we, his close associates and fellow members of the board of trustees of the Habirshaw Wire Company, fully share.

Resolved, That, as a mark of respect for the character of William M. Habirshaw, and as an expression of our loss in his death, the works and general offices of the company be closed on the day of his funeral, Wednesday, August 19th, 1908.

Resolved, That a copy of these minutes and resolutions be sent to his family.

The beautiful and impressive Episcopal service was publicly held at St. Thomas' Church, New York City, August 19th. The presence of numerous friends and a profusion of flowers testified to the regard in which he was held.

This was immediately followed by private funeral services, after which the body was cremated, in accordance with his wish.

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Dossert & Co., 242 West Forty-first Street, New York City, send an attractive catalogue of Dossert Solderless Connectors, Cable Taps and Terminals. Much valuable information is compactly presented therein.

## SIXTEENTH ANNUAL CONVENTION OF PACIFIC COAST GAS ASSOCIATION.

The following arrangements have been made for the Sixteenth Convention of the Pacific Coast Gas Association at Santa Cruz, September 15th, 16th and 17th:

The Southern Pacific Company will put into effect their convention rate of one and one-third of lowest first-class fare, for the round trip, from all points in California, including Reno, Nevada, to Santa Cruz and return. Tickets for going trip may be purchased from September 5th to 17th, inclusive, and the certificates will be honored for the return at one-third rate from September 15th to 19th. The Santa Fe Railroad Company has notified us that the same rate will apply from all points on its lines in the San Joaquin Valley. At the time of purchasing your ticket, be sure and secure your "receipt certificate," in order that you may derive the benefit of the above rate. The railroad companies have notified us that they will not consider any request for the refund in the event of members failing to obtain the receipt certificates at the time of purchasing their tickets.

The following special rates have been named: For the reception of the members, the Sea Beach Hotel, which was to have closed on September 14th, has consented to remain open until after the convention, and has named the following rates for members and their families: $3.00 per day for room without bath—American plan; $4.00 per day for room with bath. St. George Hotel (American plan), $2.50 per day.

The general manager of the Santa Cruz Beach Company has made the following rates for the members desiring to stop at Cottage City: For single-room cottage, $1.00 per day for one person; fifty cents extra if occupied by two people. For double-room cottage, $1.25 per day, and fifty cents extra per person if occupied by more than two people. Meals can be had at the Casino Grill at all hours.

Get busy, now, and make your arrangements accordingly, and if you don't enjoy your outing it will be through no fault of the Association.

In connection with literature of the Association, there is in stock forty books of Volume 1 of the Proceedings, embracing the years 1893 to 1897, both inclusive; also quite a number of Volume 6, embracing the years 1905 and 1906, which we will be glad to forward members, while the supply lasts, at the price of $1.00 for each volume, postpaid; cash to accompany order.

There is also a small supply of the "Rix Pamphlet" covering paper read before the thirteenth convention of the Association, by Mr. E. A. Rix, on "The Compression and Transmission of Illuminating Gas," which will be forwarded to members, postpaid, upon receipt of fifty cents; cash to accompany order. It may be that some of the members desire to purchase the above for presentation to the libraries in their respective localities.

JOHN A. BRITTON,
Secretary.

## NOTICE TO REJUVENATED SONS OF JOVE.

**It behooves us as Rejuvenated Sons of Jove to assemble from time to time, in order that good fellowship may prevail and that the many virtues of our members may not be lost sight of. To this end, I have set apart, Friday evening of September 4th, at seven o'clock, and command you to forego all other demands upon your time which will conflict and be present at a Jovian, which will be held in Solari's Restaurant at seven o'clock, September 4th. The charge per plate will be $2.00. In order that the proper number of plates will be laid for this Jovian, it is necessary for you to advise me at once. Come and bring the best of spirits with you.**

**Charles E. Wiggin, No. 1003 Mercury.**
**By order of T. E. Bibbins.**
**JOVIAN STATESMAN OF CALIFORNIA.**

## WATER POWER DEVELOPMENT IN NATIONAL FORESTS.

The Editor.

Sir: I have read several dissenting opinions, but no substantial argument against the general proposition advocated by Mr. Frank G. Baum, "to encourage water-power development as much as possible and make grants for rights of way and lands necessary for development permanent" in forest reservations.

There is no objection to the principle of forest preservation, and there will be no objection to a sane and just policy of administration. To what extent forests maintain stream flow is a much-mooted question. The greatest water power in America, Niagara, maintains an undiminished flow though the forests in its drainage area have steadily decreased. The island of Ceylon, where hundreds of thousands of acres have been denuded of the jungle growth and cultivated, has not eroded sufficiently to cause comment, though it has steep slopes and a mean annual rainfall of 110 inches, with an occasional precipitation of more than 10 inches in 24 hours. The rainfall in France has gradually increased in the last 300 years, and it is doubtful if its forested area has grown in the same time. But the value of the Bureau of Forestry to maintenance of stream flow, and its consequent value to power producers, is a question that should be easily disposed of. The all-important question is, Will men invest in developing water powers wholly or partially in forest reservations on a mere permit revocable at any time by a Cabinet officer, who may be "one of the best fellows in the world," but really lacking in business experience and judgment? The strong probabilities are that they will not. If not, then water-power development in forest reservations stops until forestry regulations are modified.

Any arrangement for the development and operation of an industry, whether on public or private land, must be founded on a sound business basis, and the investment must be safeguarded precisely alike in each case, and before we upset with a single stroke the plan of individual effort which has produced the greatest development the world has ever known, we should pause long enough to know that we are right before we go ahead.

The suggestion of Mr. John A. Britton that a convention be called should be acted upon, and a consensus of opinion crystallized into a definite plan for relief from the unjust discrimination made against power companies.

C. A. W.

San Francisco, August 27.

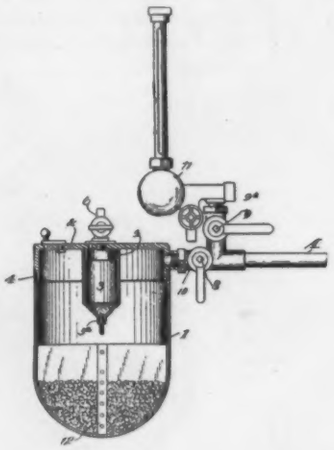
## DEATH OF W. N. ROWLES.

W. N. Rowles died near Richmond, in Surrey-on-the-Thames, England, August 6th, 1908, of neurasthenia, at the age of twenty-seven. Mr. Rowles was in the employ of the Western Electric Company for a number of years, located originally at Chicago, and later took charge of the telephone warehouse of that company on their opening business in Los Angeles. From there he was transferred to Seattle, where he was in charge of the telephone supply business of the same company, and later was placed in charge of the stock department of the California Electrical Works, of San Francisco. It was during his latter work that the illness developed which made it necessary for him to take a rest, and resulted in a trip, in May of this year, to his old home in England, where his death occurred. He was a faithful and loyal worker, and his bright and cheerful disposition made him many friends on the Coast, who will regret sincerely to hear of his death.

# PATENTS

GAS-LEAK DETECTOR. 895,815. Ellis I. Thomas, Oakland, Cal.

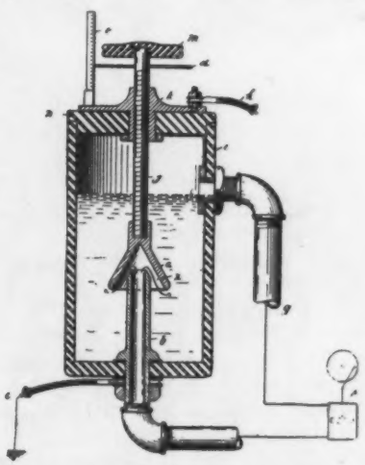
In a testing apparatus of the character described, the combination of an acetylene generator, connections between the generator and the pipe system to be tested, a supplemental pipe



connecting with the system and having a mercury gas-gauge connected therewith, a cock in the pipe system between the generator and the supplemental pipe, by which the system may be cut out of connection with the generator, and a cock in the supplemental pipe by which the connection with the mercury gauge may be opened to register pressure from within the pipe system.

VOLTAGE-PROTECTOR. 895,854. George T. Hanchett, Hackensack, and Henry M. Shaw, East Orange, N. J.

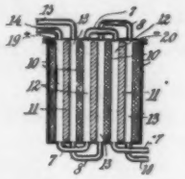
The combination of a container adapted to contain a non-conducting liquid, two relatively stationary terminals having op-



posing faces submerged in said non-conducting liquid, the face of one of said terminals having a cavity therein and the other terminal having a passage there-through, and means for causing the non-conducting liquid to move toward said cavity and through said passage.

THERMO-CHEMICAL GENERATION OF ELECTRICITY. 895,715. Lucien P. Basset, Paris, France, assignor to Maurice Bacqua de Labarthe, Paris, France.

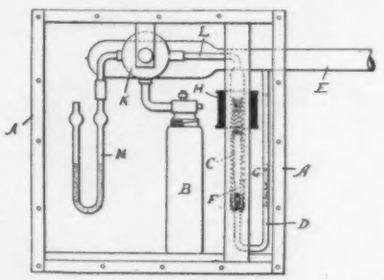
A process of generating electricity, consisting in circulating two electrolytes separately in compartments separated by porous walls, one of the electrolytes being a weak solution of sulphuric



acid containing sulphurous acid, and the other being a weak solution of sulphuric acid containing bromin, said electrolytes reacting on each other so as to form hydrobromic acid and sulphuric acid, and regenerating the electrolyte by heat into bromin and sulphurous acid.

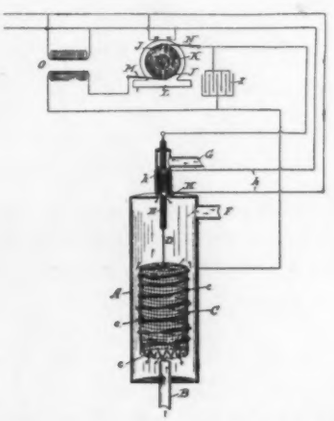
VACUUM-TUBE APPARATUS. 895,486. Daniel M. Moore, Newark, N. J., assignor to Moore Electrical Company, New York, N. Y.

The combination of a vacuum tube containing a gas in rarefied condition, a tank containing a supply of gas of the



desired kind under compression, a valve through which the gas is admitted to the tube automatically in response to changes of gas tension therein and a pressure-reducing valve between said valve and the tank.

ART OF SEPARATING SUSPENDED PARTICLES FROM GASEOUS BODIES. 895,729. Frederick G. Cottrell, Berkeley, Cal., assignor to International Precipitation Company, San Francisco, Cal.



The improvement in the art of separating suspended particles from gaseous bodies, which consists in subjecting said gaseous bodies to the action of a system of electrodes maintained at a high difference of electrical potential by intermittent connection with a source of alternating current, at intervals synchronized with the period of said current.

# INDUSTRIAL

## DEVELOPMENT OF AN ELECTRICAL MANUFACTURING INDUSTRY.

Down among the orange groves, at Ontario, California, is one of the sharp contrasts that one encounters in our Western States—a hustling, bustling factory almost immediately surrounded by orchards. You might think they made marmalade—but they make electric flat irons and other appliances. The business of the Pacific Electric Heating Company has been developed steadily and quite rapidly, the company now employing 125 people regularly and shipping its Hot Point domestic irons into every State in the Union. The main office is located in Ontario, with branch offices at Chicago, San Francisco and Los Angeles.

This company has devoted its best energies to the development and construction of electric laundry irons. These are built in sixteen different sizes, varying from four to thirty pounds. A very large percentage of the irons are used upon residence connections at lighting rates, so that the introduction of these irons is very profitable to the lighting company.

Factory of Pacific Electric Heating Co. at Ontario, Calif.

On analysis we find that the development of the Pacific Electric Heating Company of Ontario is especially interesting for two reasons: First, they are by far the largest manufacturers of electrically-heated appliances located west of the Mississippi River; second, the factory is located in the midst of a fruit-growing community, forty miles east of Los Angeles.

We naturally asked the question which first occurs to any one familiar with manufacturing conditions—why did they locate in Ontario? The best answer is this brief story of the development of the business. Seven years ago the Ontario Power Company was organized to develop water-power owned by the San Antonio Water Company, of Ontario. A complete up-to-date hydraulic plant was installed, with a capacity of from 500 to 1,500 horsepower, depending upon the flow of the San Antonio Creek, from which the power was derived. This power was used principally for pumping purposes, and secondly for lighting the town of Ontario.

It soon developed that during eighty or ninety per cent of the time there was more power than could be used to advantage for the above purposes, but not sufficient surplus power to warrant them in extending their lines to nearby towns in order to sell this power through the usual channels. The Ontario Power Company, therefore, decided to increase the local market for this power, and to this end placed trial orders with several Eastern manufacturers of electrically-heated appliances. They were thoroughly tried out and, while not wholly satisfactory, they offered a possible market which the company decided to develop.

It was further decided that they could build the devices themselves, to meet their local demand. Construction work was inaugurated in their principal sub-station at Upland, two miles north of Ontario. This work resulted in the construction of about 150 electric irons along lines considerably different from those employed by the regular manufacturers. These irons were the predecessor of the present Hot Point iron, and presented some of its characteristics. They were manufactured under the supervision of E. H. Richardson, the company's electrical engineer, and the iron has been developed by him to its present position among the leaders.

In addition to the irons, approximately 175 small portable electric cooking stoves and sixty ovens were built and distributed among the local lighting consumers, forming complete cooking equipments for sixtv Ontario kitchens. A special rate for current for cooking purposes was inaugurated, this rate being three cents per kilowatt hour, with a minimum charge of $3.00 per month. Under this rate it was found that electric cooking was somewhat more expensive than gasoline. However, there was no gas service in Ontario, and gasoline being considered by most people dangerous, the electric cooking was quite readily adopted, and, on the whole, has proved very satisfactory.

As a result of the above work and experience, the Pacific Electric Heating Company was incorporated some four and a half years ago for the purpose of building electrically-heated appliances for the general market. Mr. Richardson is heavily interested and is in active management of the factory. This company began operations in the spring of 1904,

in one corner of an abandoned store building, employing one man and three boys during the first three months.

The business grew steadily until in the latter part of the year 1906 it was found necessary to select a permanent location and erect a plant. After spending several months in looking over different locations throughout Southern California, it was unanimously decided by the officers of the Pacific Electric Heating Company, that they could do no better than to locate their permanent plant in Ontario.

Perhaps the first and most important reason for this decision was the fact that they were offered all the current which they might use in connection with their manufacturing work for five years at a nominal rate. Second, they were enabled to secure a very satisfactory site for their plant, located within a couple of hundred feet of two transcontinental railroads. Third, they had found from past experience that they were able to secure an unusually high class of employees in Ontario, the environment being favorable for steady and reliable service. The most serious disadvantage in a location of this sort is the freight rates, there being a short haul from Los Angeles to Ontario on nearly all goods bought and sold.

The factory consists, in reality, of three buildings. A two-story brick building which houses the general offices, the shipping department, the store room and stock department on the ground floor, with the printing establishment and a number of the minor manufacturing departments on the second floor.

Connected with this is a one-story reinforced concrete structure, built especially for the purpose, on the most modern lines, with ample outside light and air, cement floor and other conveniences. This is the factory proper. It connects on the right with the store room in the main building, where the supplies are secured. They travel down the right-hand side of the building through the various machine departments and return up the left side of the building, gradually assuming the shape of the completed work until they approach the shipping room on the left-hand side of the main building.

The third building is devoted exclusively to the foundry, and is detached. It contains complete iron and brass casting facilities, including moulding machines and a number of other devices not commonly found in commercial foundries.

The entire plant is carefully systemized and arranged for the greatest economy in manufacturing. The power, as explained above, is entirely electrical. Electricity is also used in some very unusual ways, as, for instance, in the plating department where the water is all heated electrically, and in the foundry where an electrically-heated brass furnace has passed the early experimental stages and will soon be in successful operation.

While the catalogue of the company shows a very broad line of electrical appliances the work has been specialized on irons, and very little effort has been made to press the sale of cooking and heating appliances, as their successful use calls for a low rate for current, which lighting companies seem hardly ready to give as yet.

**Where "Hot Point" Flat Irons are Made.**

The factory has a normal capacity for 500 irons a day, but this output can be increased under pressure. Probably the most distinguishing point of the Pacific Electric Flat Iron is the fact that it uses two complete heating elements lying in the iron in V shape, coming together at the point, and this gives the "Hot Point" which the company uses so extensively in its advertising.

## TRADE CATALOGUES.

Bulletins Nos. 4601 and 4602, from the General Electric Company, Schenectady, N. Y., fully describe automatic voltage regulators for alternating and direct current generators respectively, and contain diagrams showing the various connections and arrangements of the different styles of regulators.

The Electrocraft Publishing Co., Detroit, Mich., announce that the third edition of the Electrocraft Illustrated List of Approved Electrical Supplies will shortly be issued and that copies will be sent (free of charge) only to actual buyers of electrical supplies and persons directly influencing buying. The publishers request immediate applications for copies, to be made on the letter heads of the applicants and accompanied by ten cents in stamps or silver to pay postage.

## ILLUMINATION OF A LARGE OFFICE.

Office lighting is rightly regarded as one of the difficult problems in illumination. Bookkeeping requires close application, and demands such constant service of the eyes, that office men are notoriously sensitive to the lighting conditions. Especially is this true in a large office where many employees are grouped together. Architects are giving more and more thought to the provision of suitable day illumination while the demand for improvement in artificial illumination is even more imperative.

The simplest and most common method of office lighting is to provide small individual units in the form of desk or drop lights. In many cases this is the best available form of

**Fig. 1. Natural Illumination.**

illumination, especially when the working illumination is required only at isolated points. Perhaps the most serious fault to which this method of illumination is commonly subject, is the glare of the lamps themselves, or of the light reflected from desks or papers.

It is not unusual, on entering an office, to find the fixtures draped with all kinds of shades and provided with the

**Fig. 2. Artificial Illumination.**

highest-power lamps obtainable. This is an indication of unsatisfactory illumination. Unfortunately, instead of improving the illumination, the experiments generally result in increased glare and, consequently, increased eye-strain.

A more modern office lighting is by general illumination, produced by larger units installed near the ceiling, and so arranged as to give even illumination. Where work is sufficiently concentrated, this method of illumination is cheaper to install and operate. A fine-appearing installation can be produced, which will not clutter up the room and will not suggest interference on the part of the employees.

In making such an installation it is advisable to use considerable care in selecting the unit so as to produce a satisfactory result. The light source should be of low intrinsic brilliancy, with a relatively large diffusing surface, in order to avoid glare, and dense contrasty shadows. The lamp should be economical to operate, and should distribute the light so as to produce an approximately even intensity of illumination in all parts of the room.

The capacity of the unit should be as large as possible, consistent with an even distribution. In a large room with a high ceiling a relatively large unit may be used. A number of different arc and incandescent lamp combinations are available for this class of lighting. The equipment most suitable for a particular case frequently depends upon local conditions.

A representative installation in which an excellent illumination is produced by means of the Ceiling Diffuser Arc Lighting System, is in the offices of the Stanley Works, manufacturers of builders' hardware, at New Britain, Conn. This company completed a new office building in the late summer of 1907. The artificial lighting of the large general office was planned by the illuminating engineering department of the General Electric Company, in co-operation with the architects and the purchasing department of the Stanley Works.

The room in question has a 22-foot stud. The working area is 82x75 feet, and is lighted by means of twenty-four 6-ampere direct-current enclosed arc lamps, with the recessed type of ceiling diffusers, consuming 15.8 kilowatts.

The lighting has been in service throughout the dark winter months, and has given entire satisfaction to both the company and the employees. The excellent illumination of the office, both by daylight and artificial light, is illustrated by the accompanying photographs, which were made under the regular lighting conditions, without flash-light or any special treatment.

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## MORE ELECTRICAL MACHINERY FOR GUADALAJARA. LARGE EXTENSION TO JUANACATLAN PLANT.

The Compania de Transvias Luz y Fuerza de Guadalajara, S. A., which company is the result of the combination of the two former electrical companies of that city, and operates not only the entire lighting system, but also the railway system of Guadalajara, have en route to Mexico a large order for additional electrical machinery which was bought from Messrs. G. & O. Braniff & Company, of Mexico City. In order to meet the increasing demand for electrical power in Guadalajara, this company, finding that their power generating stations at La Junta and Juanacatlan were insufficient, found it necessary to purchase a 750-K. V. A., modern, Westinghouse, three-phase, belted type generator, which will be installed at Juanacatlan. This new generator is but one of the four which will be installed as needed.

The latter station was one of the first electric power plants in the country, the original installation consisting of single-phase machines, which were added to from time to time by other machines of the same type, as growth necessitated. A more modern method of transmitting electrical energy is by means of three-phase current, on account of the saving of amount of copper required in the transmission line, and is now almost universally in use. By this change a greater amount of electrical energy is obtained from the same amount of water power by the adoption of this more modern type of machine, even by the use of the present water wheels, which will be retained in service.

The Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., are supplying the new electrical machinery. This extension was necessitated not only by the operating of electrical railways in Guadalajara, which now have been in service for the last several months, but also by the additional power required from their present and new subscribers.